CLAIMS

WHAT IS CLAIMED IS:

1. A stabilized dual zeolite low coke forming single particle catalyst, bonded with silica alumina binder, suitable for cracking heavy residual hydrocarbon feeds and having enhanced hydrothermal stability, said catalyst comprising:
   (a) stabilized high silica zeolite in the range of 1 wt% to 50 wt%;
   (b) low silica molecular sieve in the range of 1 wt% to 40 wt%;
   (c) silica in the range of 1 wt% to 15 wt%;
   (d) alumina in the range of 5 wt% to 30 wt%; and
   (e) clay in the range of 10 wt% to 50wt%;

2. A catalyst according to claim 1 wherein the stabilized high silica zeolite consisting of:
   (a) a phosphate source in the range of 1 wt% to 40 wt%;
   (b) high silica zeolite in the range of 5 wt% to 99 wt%; and
   (c) clay in the range of 0 wt% to 50 wt%.

3. A catalyst according to claims 1 and 2 wherein the clay is selected from the group consisting of kaolin and halloysite.

4. A catalyst according to claim 1 wherein the high silica zeolite is selected from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-23, ZSM-35, ZSM-38, ZSM-48, ZSM-57, Zeolite beta, mordenite and preferably ZSM-5.

5. A catalyst according to claim 1 wherein the low silica molecular sieve is selected from the group consisting of faujasite, mordenite, beta, MCM mesoporous zeolite and L.

6. A catalyst according to claim 1 wherein the low silica molecular sieve is exchanged with NH_3.

7. A catalyst according to claim1 wherein the low silica molecular sieve is exchanged with rare earth cations selected from the group consisting of lanthanum, cerium, praseodymium, neodymium, samarium and gadolinium.

8. A catalyst according to claim 1 wherein the low silica molecular sieve having rare earth metal oxides in the range of 0.1 to 10 wt%.

9. A catalyst according to claim 1 wherein the phosphate source is selected from the group consisting of phosphoric acid, ammonium di hydrogen phosphate, ammonium mono hydrogen phosphate, tri-ammonium phosphate, ammonium hypophosphate, ammonium ortho phosphate, ammonium di hydrogen ortho-phosphate, ammonium mono hydrogen ortho-phosphate, ammonium hypo phosphite, ammonium di hydrogen ortho-phosphite or a mixture thereof.

10. A catalyst according to claim 1 wherein the alumina is a pseudoboehmite having a crystal size ranging from about 3 nm to 30 nm.

11. A catalyst according to claim 1 wherein the silica is in colloidal form of particles having a mean diameter ranging from about 4 nm to 30 nm.

12. A catalyst according to claim 1 wherein the stabilized high silica zeolite has silica to alumina ratio from 10 to 300.

13. A catalyst according to claim 1 wherein the silica alumina binder is a reaction product of acidified colloidal silica and acidified pseudoboehmite alumina.

14. A catalyst according to claim 1 wherein the organic acid used for acidifying colloidal silica is selected from the group consisting of nitric acid, hydrochloric acid, formic acid and acetic acid.

15. A catalyst according to claim 1 wherein the organic acid used for acidifying pseudoboehmite alumina is selected from the group consisting of acetic acid, formic acid, nitric acid and hydrochloric acid or a mixture thereof.

16. A catalyst according to claim 1 wherein said catalyst produces gasoline having Research Octane Number (RON) 92-93.

17. A catalyst according to claim 1 wherein the particle size of the catalyst is the range of 20-150 microns.

18. A catalyst according to claim1 wherein the particle size of the catalyst is in the range of 30-100 microns.

19. A catalyst according to claim 1 wherein said catalyst having reduced coke formation property in the range of 12.99 –12 wt%.

20. A process for preparing hydrocarbon conversion, stabilized dual zeolite catalyst, comprising essentially of stabilized high silica zeolite and a low silica molecular sieve, said process comprising the steps of:

(a) loading high silica zeolite into a reactor and maintaining the zeolite at a temperature ranging between 100-125°C for about 30 minutes;

(b) heating the high silica zeolite to a temperature in the range of 450-500°C for about 90 minutes in nitrogen atmosphere;

(c) holding the zeolite at about 450-600°C for about 90 minutes in an atmosphere steam containing phosphate;

(d) cooling the zeolite to obtain stabilized high silica zeolite;

(e) treating an alumina with a dilute organic acid and gelling it for about 10 minutes to obtain alumina binder;

(f) adding demineralised water to the gel alumina to make the alumina binder free flowing;

(g) adding acidified ammonium polysilicate to the gel alumina;

(h) adding milled clay slurry to the product of step(h);

(i) adding milled slurry of low silica molecular sieve;

(j) adding demineralised water to obtain silica-alumina-clay- low silica molecular sieve slurry;

(k) adding the stabilized high silica zeolite as obtained in step (d) to the silica-alumina-clay-low silica molecular sieve slurry of step (j); and

(l) spray-drying the slurry and calcining the same to obtain the stabilized dual zeolite catalyst.

21. A process according to claim 20 stabilization of high silica zeolite can be optionally performed in the following steps:

(a) preparing phosphate-clay slurry using a phosphate source and a clay with demineralised water;

(b) adding high silica zeolite to the slurry;

(c) drying the product at a temperature in the range of 60-120°C in an oven; and

(d) pulverizing the product followed by calcination at about 400-600°C to obtain stabilized high silica zeolite;

22. A process according to claim 20 wherein the stabilized high silica zeolite has silica to alumina ratio from 10 to 300.

23. A process according to claim 20 wherein the high silica zeolite is selected from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-23, ZSM-35, ZSM-38, ZSM-48, ZSM-57, Zeolite beta, mordenite and preferably ZSM-5.

24. A process according to claim 20 wherein the stabilized high silica zeolite contains optionally clay selected from the group consisting of kaolin and halloysite.

25. A process according to claim 20 wherein the phosphate source is selected from the group consisting of phosphoric acid, ammonium di hydrogen phosphate, ammonium mono hydrogen phosphate, tri-ammonium phosphate, ammonium hypophosphate, ammonium ortho phosphate, ammonium di hydrogen ortho-phosphate, ammonium mono hydrogen ortho-phosphate, ammonium hypo phosphite, ammonium di hydrogen ortho-phosphite or a mixture thereof.

26. A process according to claim 20 wherein the colloidal silica sol has a pH between 7.0 and 11.5.

27. A process according to claim 20 wherein the colloidal silica consists of silica particles having a mean diameter ranging from about 4 nm to 30 nm.

28. A process according to claim 20 wherein the colloidal silica contains soda in the range of from 0.01 to 0.20 wt%.

29. A process according to claim 20 wherein said silica sol is acidified to a pH between 0.5 and 3.5 before use.

30. A process according to claim 20 wherein said silica sol is acidified using a acid selected from group consisting of nitric acid, hydrochloric acid, formic acid and acetic acid.

31. A process according to claim 20 wherein said alumina is a pseudoboehmite.

32. A process according to claim 20 wherein said alumina has crystallite size ranging from about 3 nm to about 30 nm.

33. A process according to claim 20 wherein said alumina has soda content ranging between 0.001 and 0.1 wt%.

34. A process according to claim 20 wherein the alumina used is acidified using acids selected from the group consisting of acetic acid, formic acid, nitric acid and hydrochloric acid or a mixture thereof.

35. A process according to claim 20 wherein ratio of high silica zeolite to low silica molecular sieve is in the range of 1-50:1-40.